

**IN THE SPECIFICATION:**

For the purposes of line numbers referred to herein, lines of text as well as blank lines between paragraphs are counted. Accordingly, beginning the numbering with the first line of the text after the title, the heading "Description of the Related Art" is on line 7, the heading "Summary of the Invention" is on line 17 of the text as originally filed, and so on.

On page 1, please amend the fourth paragraph beginning on line 18, as follows:

--In view of the foregoing, one object of the present invention is to overcome the difficulties of accurately analyzing arbitrary or ambiguous sentences in natural languages using a computer-assisted system implemented using a computer--

On page 2, please amend the third paragraph beginning on line 5, as follows:

--Yet another object of the invention is a computer-implemented parser enabling a language student to obtain a syntactically bracketed grammar structure for a correct sentence in which student errors are noted in a ~~parsed~~ parse or grammar tree--

On page 2, please amend the fifth paragraph beginning on line 12, as follows:

--In accordance with ~~this~~ these and other objects, the present invention builds from a flexible intelligent computer-assisted language learning (ICALL) system which provides a realistic, computer-implementable method for intelligent language tutoring of foreign languages, particularly second language composition and/or technical translation. Such a system is set forth in pending U.S.

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Patent applications, serial numbers 09/597,269 and 09/597,270 which applications are hereby incorporated herein by reference in their entirety.--

On page 2, please amend the sixth paragraph beginning on line 18, as follows:

--The template-automaton-based ICALL system provides on-line tutoring capability for English composition using a computer which enables teachers to build in pedagogic contents and plan a learning strategy without any help from knowledge engineers. In the ICALL system, expertise in grammar analysis and grammatical remediation is extracted into the knowledge base of templates by language experts. In the referenced patent applications as incorporated herein, a robust algorithm is developed for bug identification by matching the input sentence against template paths stored in the computer. This algorithm is capable of predicting a most plausible incorrect sentence in view of the errors students commit, thereby generating the most contingent remediative feedback to student errors. This implies that, if an accurate parser capable of processing a well-formed sentence (s) can be provided, the parser can also be used to process the syntactically erroneous inputs by merely pointing out the differences. Yet, even for sentences that are grammatically correct, it is still necessary to develop a parser program that can consistently provide a correct grammar tree.--

On page 3, please amend the first full paragraph beginning on line 7, as follows:

--In the present invention, a part-of-speech tagged (POST) parser is constructed which is capable of providing an accurate grammar tree of a well-formed sentence(s) in the

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templates. To implement the POST parser scheme to the current template in the ICALL, the structure of the template is modified so that the part-of-speech tags may be added to any word or phrase in the correct nodes of the template. After adding necessary part-of-speech tags sufficient for disambiguation purpose into the template, some known probabilistic parsers may be used to obtain grammar trees of correct sentences in the templates, by ignoring the tagging process with respect to the words or phrases that have been manually tagged by language experts. By using the so-called part-of-speech tagged parser, it is possible to modify the whole process of the ICALL system.--

On page 3, please amend the second full paragraph beginning on line 16, as follows:

--The present invention is further directed to a computer-implemented learners' model which, by identifying a "minimum syntactic subtree" or smallest grammar component of a relevant error, is effective in describing the grammar errors of an input sentence and may be used to maintain a historical record of each student describing a grammar error table together with its location visualized within the syntactic subtrees.--

On page 5, after line 6, please insert the following new paragraph:

--According to the rule base and the possible tags of each word stored in any probabilistic context free grammar, including Apple-Pie, a plurality of grammar trees are obtained using a standard bottom-up chart approach (See, for example, James Allen, Natural Language Understanding, 2<sup>nd</sup> ed, Benjamin/Cummins Publishing Company, Inc., pp. 54-60). The above

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formula for calculating the final grammar tree is then used to select the grammar tree with largest probability.--

On page 5, please amend the first full paragraph beginning on line 7, as follows:

--Two major modifications are made to the algorithm of the Apple-Pie parser. First, any phrase preassigned with a POS tag is regarded as *one* word. Second, when preassigned, the probability of such words is always regarded as "1" , setting probabilities of words having a tag as "0" if the words have been assigned with a different tag.--

On page 6, please amend the paragraph beginning on line 8, as follows:

--The procedure for applying the POST parser in the template-automaton-based ICALL system for the individual remediation of syntactic errors is summarized in Figure 2. More specifically, for the given student's input sentence, which is generally keyed into a computer, the method begins by reading ~~a keyed-in~~ the input sentence, step 100. The sentence is checked with a standard spell check model, and spelling errors are corrected, step 200. Template matching is then undertaken by the computer with the template matching algorithm set forth in the referenced patent applications, step 300. Using this algorithm, the best matched path having a highest similarity value with the sentence is selected, lexical error information is printed, and the score of the input sentence is calculated, step 310. Feedback information is also provided.--

On page 6, please amend the paragraph beginning on line 16, as follows:

--According to the error feedback information, the correct path in the template is identified, step 321. The POST parser is then applied to obtain a syntactically bracketed grammar structure for the correct path, step 322. The ~~parsed~~ grammar tree of the correct path is then drawn, with the errors marked at the leaves of ~~the relevant~~ such grammar tree, step 323.--

On page 7, please amend the first full paragraph beginning on line 4, as follows:

--Finally, according to step 323 and as representatively shown in Figure 3, the ~~parsed~~ grammar tree of the correct path is drawn with the errors made by the student marked thereon. The errors may be marked in red within the relevant leaves of the grammar tree. In Figure 3, the words “are”, “by” and “park” would be marked in red.--

On page 8, please amend the first paragraph beginning on line 1, as follows:

--The learners' model according to the present invention provides a computer-implemented system and method for evaluating the proficiency level of a student's writing ability, recognizing grammatical errors, and providing proficiency level contingent feedback and remediation.--

On page 8, please amend the paragraph beginning on line 15 and after the heading “B. Grammar Error Recognition,” through page 9, line 9, as follows:

--As already noted, the present invention ~~performs~~ uses a computer to perform grammar error recognition on the basis of a Minimum Syntactic Subtree, which may be defined by

example. Suppose  $a$  is the nearest ancestor of leaf  $b$ , which has at least two direct descendants. The set of trees including all the direct descendants of  $a$ , and the ancestors of  $b$  up to  $a$ , is called a Minimum Syntactic Subtree of leaf  $b$ . A syntactic error is defined as the minimum syntactic subtree of a leaf of the grammar tree that is matched with the words marked as errors.

The procedure of recording and correcting the syntactic errors detected using the computer is described hereinafter. First, obtain the grammar tree of the matched correct sentence in the template by the POST parser, and match the input sentence to leaves of the grammar tree. For each leaf  $l$  of the grammar tree that is matched with the words marked as errors, find the Minimum Syntactic Subtree of leaf  $l$  and associate  $l$  with the subtree. For all the subtrees found, combine those leaves that are associated with the same subtree, i.e., allow subtrees associated with more than one leaf. For each subtree with the associated leaves, search the user's syntactic error table and if there is a same subtree in the table, add "1" to the frequency field of the row and add all the leaves of the subtree into the associated leave field of the row, if any of the leaves is not registered in the field as yet. Conversely, if there is not a same subtree in the table, add the subtree as well as the associated leaves into the table, assigning "1" to the frequency field.--

On page 9, please amend the second full paragraph beginning on line 14, as follows:

--As a second example, suppose a student has inputted to the computer a sentence, "There are no disadvantage to this models" as a translation of the Japanese sentence, meaning, "There is no disadvantage to the model", and the grammar tree shown in Figure 5 is obtained. Locating the following two syntactic subtrees with error markers, the current system will keep the

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error records in the error table: *VP(VBZ NP PP)* with the associated leaf *VBZ*, and *NP(DT NN)* with the associated leaf *NN*.--

On page 10, please amend the first paragraph after the heading on line 1, as follows:

--To complete the learners' model, the system needs to prepare several sets, for example three, of remediation materials or example sentences for each of the syntactic errors listed in the column of syntactic subtrees in a learner' syntactic error table, where each of the sets corresponds to a different level of learners. After completing a certain number of problem assignments, the computer-implemented system first finds the most frequent syntactic errors by sorting the frequency rows of the user's syntactic error table. Making use of averaged scores of a learner, an adequate level of prepared remedial materials is selected.--